Significant Advancements in z Systems Resiliency Provided by GDPS

John Thompson
IBM
jgthomps@us.ibm.com

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Agenda

- GDPS Overview
- GDPS Virtual Appliance
- GDPS/PPRC z/OS Proxy
- GDPS/MTMM (Multi-Target Metro Mirror)
Continuous Availability and Disaster Recovery

- Central point of control
  - z Systems and Distributed Servers
  - xDR for z/VM and Linux for z Systems
  - Replication infrastructure
- Real time monitoring and alert management
- Automated Recovery
  - HyperSwap for Continuous Availability
  - Planned and unplanned outages
- Configuration Infrastructure Management
  - Single site, 2-site, 3-site, 4-site
- Automated provisioning
  - CBU / OOCoD

First GDPS installation 1998, now more than 770 licenses in 46 countries

Automation
- System Automation for z/OS
- NetView for z/OS
- SA Multi-Platform
- SA Application Manager
- Multi-site Workload Lifeline

Replication
- Disk & Tape
  - Metro Mirror
  - z/OS Global Mirror
  - Global Mirror
  - DS8000/TS7700

Software
- IBM InfoSphere Data Replication (IIDR) for DB2
- IIDR for IMS
- IIDR for VSAM

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Multiple products meeting various availability objectives

**GDPS®/PPRC HM**
- Near-continuous availability of data within a data center
- Single data center
- Applications can remain active
- Near-continuous access to data in the event of a storage subsystem outage
- Recovery Point Objective equals 0
- Recovery Time Objective equals 0

**GDPS/PPRC**
- Near-continuous availability (CA) and disaster recovery (DR) within a metropolitan region
- Two data centers
- Systems can remain active
- Multisite workloads can withstand site and storage failures
- DR RPO equals 0 and RTO is less than 1 hour or
- CA RPO equals 0 and RTO minutes

**GDPS/GM and GDPS/XRC**
- Disaster recovery at extended distance
- Two data centers
- More rapid systems disaster recovery with “seconds” of data loss
- Disaster recovery for out-of-region interruptions
- RPO seconds and RTO less than 1 hour

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1Peer-to-peer remote copy (PPRC), Metro Mirror HyperSwap Manager (HM)  
2Global Mirror (GM)  
3Extended Remote Copy (XRC), zGlobal Mirror

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Multiple products meeting various availability objectives (continued)

GDPS/MGM¹ 3-site & GDPS/MzMGM² 3-site

- Near-continuous availability (CA) regionally and disaster recovery (DR) at extended distance
- Three data centers
  - Continuous availability (CA) for site disasters and Disaster recovery (DR) for regional disasters
- Designed for near-continuous availability within the region and RPO seconds and RTO less than one hour for unplanned region fail-over

GDPS/MGM¹ 4-site & GDPS/MzMGM² 4-site (SOD)

- Near-continuous availability (CA) regionally and disaster recovery (DR) at extended distance from either region
- Four data centers
  - Continuous availability (CA) and Disaster recovery (DR) when running from any site
- Designed for near-continuous availability within either region and RPO seconds and RTO less than one hour for unplanned region fail-over

GDPS/Active-Active

- Near-continuous availability, disaster recovery, and cross-site workload balancing at extended distance
- Two or more data centers
  - Disaster recovery for out-of-region interruptions
  - All sites active
- SW Replication
- RPO seconds and RTO seconds

¹Metro Global Mirror (MGM) ²Metro z/OS Global Mirror (MzGM)

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Solutions for z System platforms and for open systems

Multiplatform Resiliency for IBM z Systems (xDR):
- Extends GDPS/PPRC “IBM z/OS® support” to IBM zVM® and associated-guests along with Linux
- Coordinated IBM HyperSwap® – z/OS, z/VM with its guests, and native Linux
- Graceful shutdown and startup of Linux clusters or nodes
- Coordinated takeover – recovery from a Linux cluster failure

Distributed Cluster Manager (DCM):
- Provides near-continuous availability (CA) in both sites
- Extends GDPS to manage front-end distributed servers and clusters (IBM AIX®, HP-UX, Linux, Solaris, VMWare and Microsoft Windows)
- Support for SA AppMan and VCS with Global Cluster Option (GCO)
- Extends monitoring and management to open systems
- Extends data consistency to open systems
- Provides automation scripting for server management

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1 IBM Tivoli System Automation Application Manager (SA AppMan), 2 Veritas Cluster System (VCS)

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GDPS Virtual Appliance
GDPS Virtual Appliance is a fully integrated software solution that provides Continuous Availability & Disaster Recovery functions for Linux on z Systems with z/VM

- It is an image comprised of an operating system, the application components, an appliance management layer which makes the image self-containing, and APIs / UIs for customization, administration, and operation tailored to the appliance function
- It extends GDPS/PPRC capabilities into z/VM and Linux on z Systems environments that do not have z/OS in production
- One dedicated Linux guest is configured as xDR Proxy for GDPS
- GDPS manages PPRC environment and keeps data available & consistent for operating systems and applications
- Disaster detection and assurance of successful and fast recovery via automated processes
- Single point of control from GDPS Appliance. No need for availability of all experts for e.g. storage team, HW team, OS team, application team
HyperSwap provides the ability to non-disruptively swap from using the primary volume of a mirrored pair to using what had been the secondary volume.

A planned HyperSwap is invoked manually by operator action using GDPS facilities.

Example: planned HyperSwap initiated in advance of planned disruptive maintenance to a disk subsystem.
An unplanned HyperSwap is invoked automatically by GDPS, triggered by events that indicate the failure of a primary disk device.

HyperSwap Triggers:
- I/O errors
- Boxed devices
- Control Unit failures
- Loss of all channel paths
- “Soft failure” – I/O response time triggers
Disaster Recovery with GDPS Appliance

- In case of a site disaster, GDPS Appliance will:
  - immediately issue a freeze for all applicable primary devices to protect the integrity of the secondary data
  - reset Site1 [and Site2] systems and update all the IPL information to point to the new primary devices, and
  - re-IPL all the production systems in LPARs in Site 2

- The GDPS Appliance scripting capability is key to recovering the systems in the shortest possible time following a disaster. All of this is carried out with a single operator instruction
Summary of Requirements

GDPS Appliance hardware requirements:
- 1 LPAR with one single logical General Purpose CP
- 1 GB Memory
- 4 ECKD Disk
- 1 OSA attachment

System prerequisites
- The disks being used by z/VM and Linux to be mirrored must be ECKD disks
- z/VM 5.4 or higher, or z/VM 6.2 or higher
- A supported distribution of Linux on z Systems with latest recommended fixpack
- IBM Tivoli System Automation for Multiplatforms with latest recommended fixpack
  - Separately priced xDR for Linux feature is required

<table>
<thead>
<tr>
<th>Supported Linux distributions</th>
<th>TSAMP Release Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUSE SLES 11</td>
<td>SA MP 4.1 or higher</td>
</tr>
<tr>
<td>Red Hat 6</td>
<td>SA MP 4.1 or higher</td>
</tr>
</tbody>
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GDPS/PPRC z/OS Proxy
Multiple Sysplexes and monoplex systems

Site 1

monoplex systems

A
B
C

Site 2

GDPS sysplex

Freeze & HyperSwap
GDPS/PPRC z/OS Proxy

Site 1

monoplex systems

Site 2

GDPS sysplex

Freeze & HyperSwap

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**z/OS Proxy Basics**

- Separately priced feature of GDPS/PPRC (GDPS/PPRC only)
- Max 16 foreign systems monitored simultaneously – z/VM, Linux systems not included
- Communication to z/OS Proxy managed system(s) – CTC based (Channel To Channel)
  - xDR Communication to z/VM and Linux on z Systems – IP based
- No disk sharing between multiple sysplexes or between sysplexes and stand-alone systems

**Key benefits…**

- Satisfies requirements for K System consolidation
- Minimizes number of configurations/environments to manage and maintain
GDPS/MTMM (Multi-Target Metro Mirror)
MultiTarget Metro Mirror (MTMM)

- Data is transferred to both targets in parallel
- Pairs operate independent of each other
- Pairs may be established, suspended or removed separately
- A replication problem on one leg does not impact the other leg
- HyperSwap is possible on either leg

Provides all the benefits of PPRC synchronous mirroring plus has the additional protection of a second synchronous leg

- A typical configuration has the H2 more local than H3.
  - H2 provides for local recovery in case of a failure of H1 (Continuous Availability - CA)
  - H3 provides for a more remote recovery in the case of a more widespread failure that affects both H1 and H2 (Disaster Recovery – DR)
Recovery from a primary disk failure

- Failure at H1
- HyperSwap to H2
  - Failover H2 → H1
  - Move I/O to H2
- Resume H2 → H3 with Incremental Resync (IR)
  - Failover H3 → H1
  - Failback H2 → H3
  - Mirroring is quickly resumed
- H1 recovered
  - Failback H2 → H1

Each replication leg is tracked and managed independently
Return to normal

- HyperSwap to H1
  - Failover H1→H2
  - Move I/O to H1
- Resume H1→H2 and H1→H3 pairs
  - Failover H3→H2
  - Failback H1→H2
  - Failback H1→H3

Maintaining two PPRC secondary targets (two PPRC legs) from a single primary device
New terminology:

- “Site 1 disk” now ambiguous
- Three “disk locations:” H1, H2, and H3
- Three “replication legs:” RL1, RL2, and RL3. The replication leg between the two current secondary disks is known as the “MultiTarget Incremental Resync” or “MTIR” leg.

- Two sets of non-PPRCed CDSs in each of the disk locations. The general concepts of Normal, Site1-only, and Site2-only configurations in GDPS/PPRC also exist in GDPS/MTMM, however the concepts are not identical across the two products. For GDPS/MTMM:

  - **Normal** - CDS1 of the current primary disk storage location will be used as the Primary CDS. The Alternate CDS will be the CDS1 defined in the secondary disk storage location that provides failure isolation at a site level. This means that H3 would contain CD2 when the primary disks are running in Site1 (H1 or H2). When the primary disks are in H3,
the CDS1 defined in the secondary storage location of the current preferred swap leg would be used as the Alternate.

- **Site1** Uses CDS1 of current primary disk storage location as the Primary CDS if the primary disk storage is in H1 or H2. CDS1 of the other storage location would be used as the Alternate CDS. If the primary disk is in H3, then the CDS1 defined in the secondary storage location of the current preferred swap leg would be used as the Primary CDS, and the CDS1 defined in the other storage Site1 location would be used as the Alternate.

- **Site2** CDS1 and CDS2 of the H3 storage location would be used as the Primary and Alternate CDSs respectively.

- Although not shown, there are a number of cross-site connections between the two sites over dark, dedicated fiber, using DWDMs. There is connectivity for various host to disk FICON channel connections, PPRC links, sysplex connections for XCF signaling amongst the systems and Server Time Protocol connectivity. Additionally all servers in both sites are connected to the same HMC/SE LAN requiring the HMC/SE LAN to be cross-connected either over the DWDM fiber infrastructure or bridged over the WAN.
Key Features of new Product

- Provides the ability to HyperSwap on either or both of the PPRC legs
  - Planned HyperSwap targets the leg specified, other leg suspends
  - User policy to specify which leg is considered the 'preferred' swap leg for unplanned HyperSwap
  - Unplanned HyperSwap will occur on preferred leg if possible else, other leg attempted
- Provides ability to FREEZE impacted leg only on PPRCFAILURE failures
  - Policy options provided to specify actions to take (STOP or COND) when the last active leg suspends (action will be GO when the other leg is still duplex)
- Provides monitoring and automation to ensure reliable and rapid site switching via automated processes
Key Features of new Product (continued)

• Provides CDS management capabilities that fully support 3 storage locations
• Majority of system, sysplex and HW management and monitoring functions inherited from GDPS/PPRC
• z/VM and Linux for z Systems guests running under z/VM are supported (xDR)
Summary of Requirements and Prerequisites

Storage environment
- All disk subsystems in the configuration must be DS8870 with MC level 7.4
- Only CKD disk is supported
- FCP links mandatory

Systems and software
- z/OS 1.13 or 2.1 (or higher) plus related DFSMS, IOS, zVM PTFs
- NetView for z/OS V5.3 or V6.1 (or higher) or IBM Service Management Suite for z/OS V1.1 (or higher)
- Tivoli System Automation for z/OS V3.4 (or higher) or IBM Service Management Suite for z/OS V1.1 (or higher)
Summary of Requirements and Prerequisites (continued)

xDR Environments

- z/VM 5.4, or z/VM 6.2 or higher
- A supported distribution of Linux on z Systems with latest recommended fixpack
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IBM GDPS solutions – Value for your organization

**Experience**

**Customer acceptance**
- More than 770 IBM GDPS® licenses installed in 46 countries worldwide
- Proven technology, automated and repeatable result
- Complete implementation by experienced consultants

**Open industry standards**
- GDPS supports industry-accepted, open replication architectures (PPRC\(^1\), XRC\(^2\), Global Mirror and Fibre Channel)
- Architectures licensed by all enterprise storage vendors
- GDPS qualification program (IBM and Hitachi)

**Investment protection**
- Designed to be easily upgradeable
- Common code base for each product

**Commitment**

**Product maturity**
- Generally available since 1998
- Suite of products
- Enterprise-to-enterprise capability
- Many years of IBM z Systems® production experience
- CA and DR\(^3\) best of breed
- Continually enhanced

**Value**

**Customer focus**
- GDPS Design Council
- Synergy with IBM development labs
- Incorporates several IBM patents
- New release planned every year

**Vision**

**IBM support**
- Fully supported via standard IBM support structure
- Fixes through normal IBM z Systems® channels

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### Additional Information

- **Web sites:**
  - GDPS: [www.ibm.com/systems/z/gdps](http://www.ibm.com/systems/z/gdps)
  - Parallel Sysplex: [www.ibm.com/systems/z/pso](http://www.ibm.com/systems/z/pso)
  - Bus Resiliency z: [www.ibm.com/systems/z/resiliency](http://www.ibm.com/systems/z/resiliency)

- **z Systems:**
  - [www.ibm.com/systems/z/hardware](http://www.ibm.com/systems/z/hardware)

- **Storage:**
  - [www.ibm.com/systems/storage](http://www.ibm.com/systems/storage)

- **Redbooks®GDPS Family: An Introduction to Concepts and Capabilities**

- **GDPS Web Site White Papers and Presentations**
  - GDPS: The Ultimate e-business Availability Solution
  - IBM Implementation Services for GDPS/Global Mirror
  - GDPS Business Continuity Solutions
  - Consistency Groups in a Nutshell
  - DS8000™ Data Replication
  - GDPS Solutions

- **e-mail:**
  - gdps@us.ibm.com